



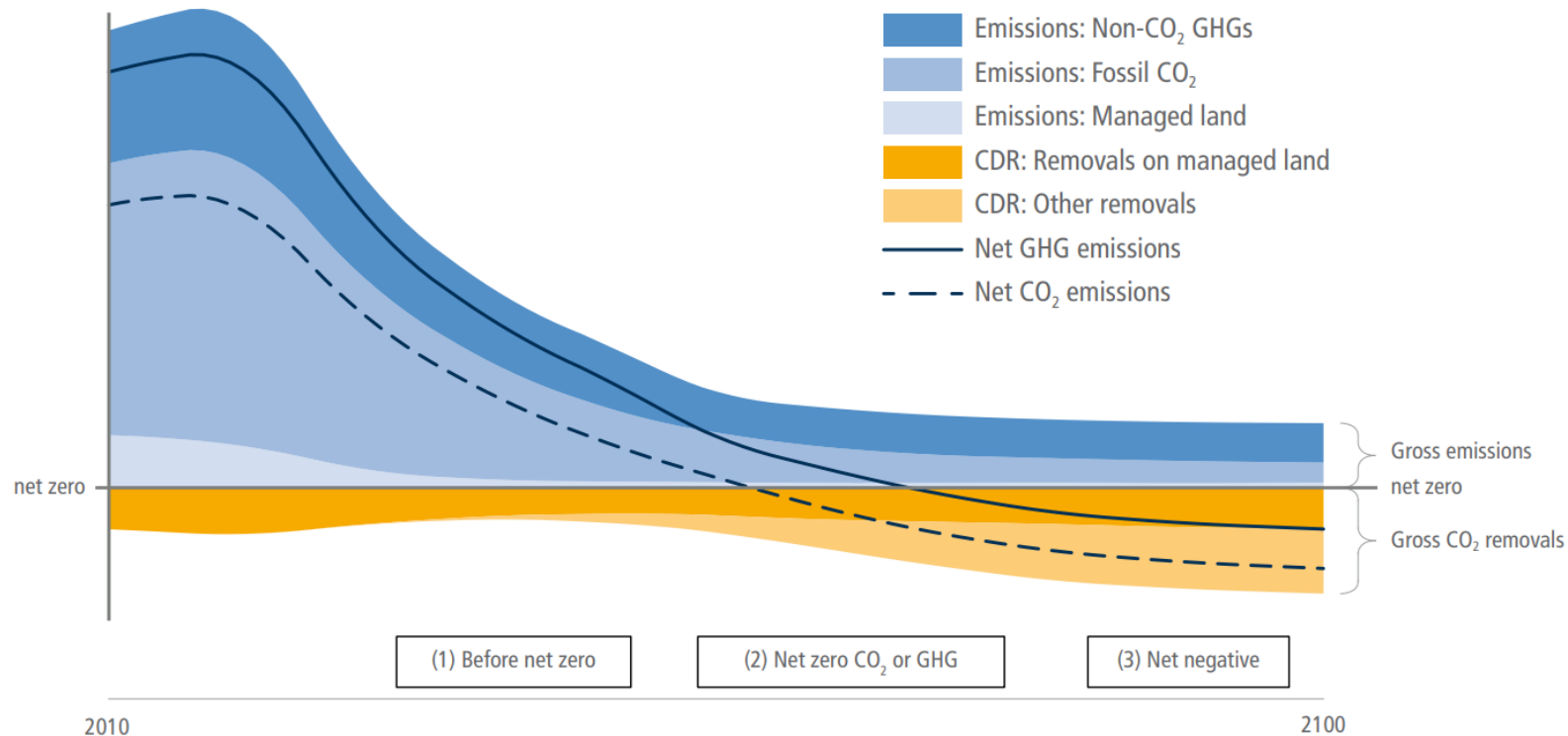
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OCEAN CARBON DIOXIDE REMOVAL

Introduction and Landscape

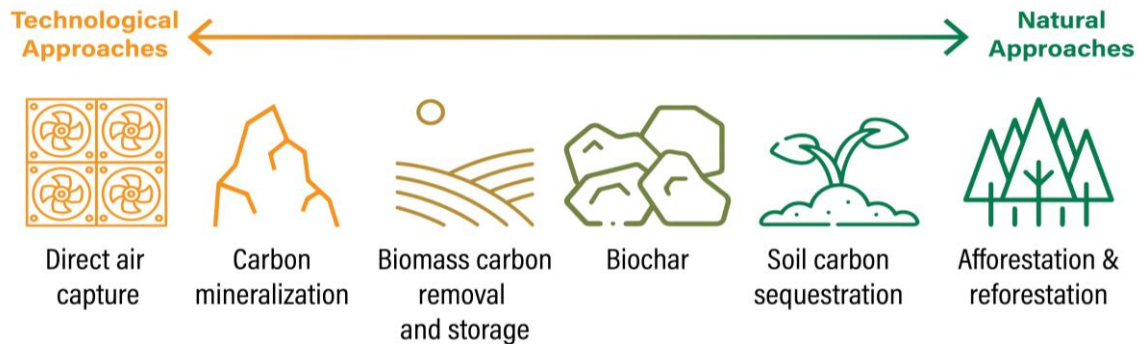
WHY WE NEED CARBON DIOXIDE REMOVAL

Greenhouse gas emissions (stylised pathway)

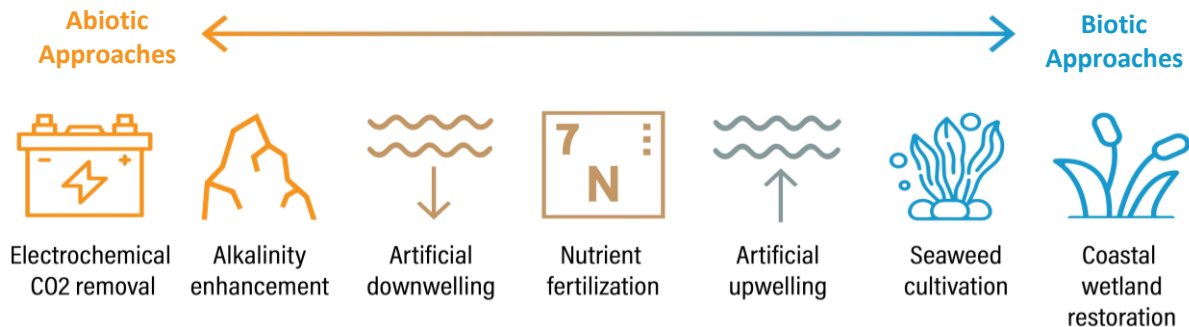


CARBON REMOVAL INCLUDES MANY THINGS

Carbon removal approaches on land

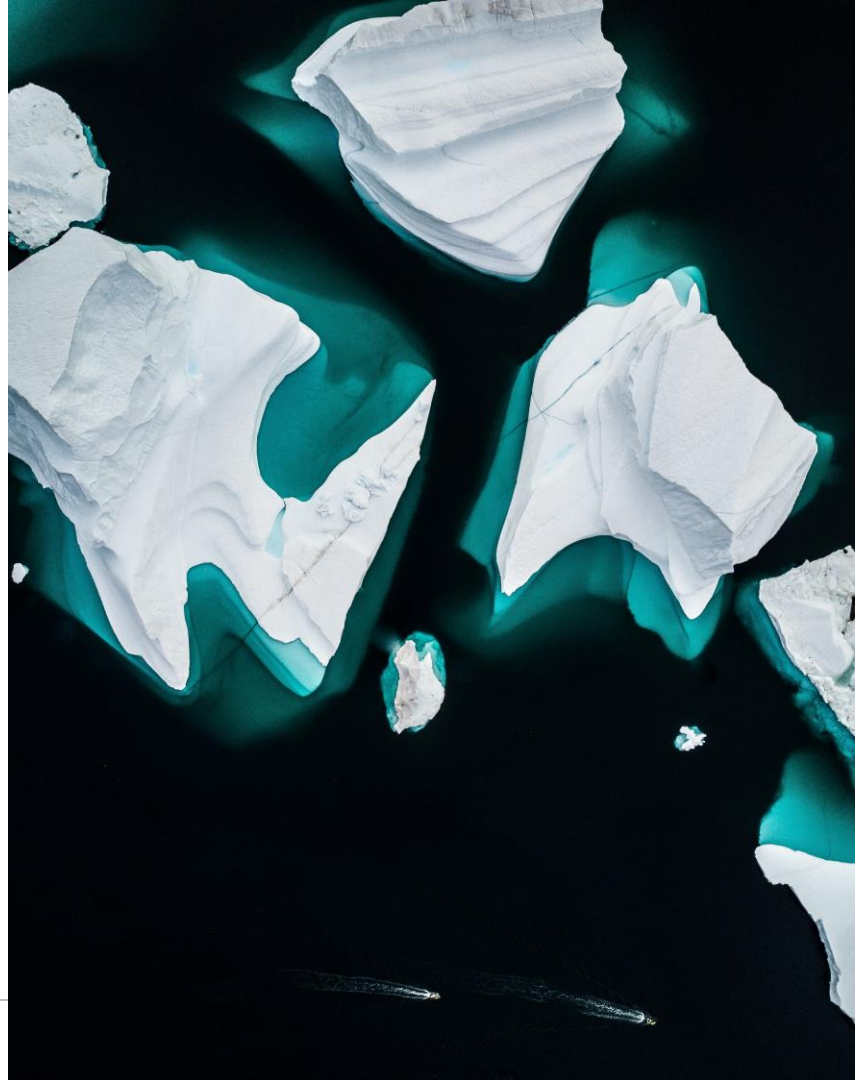


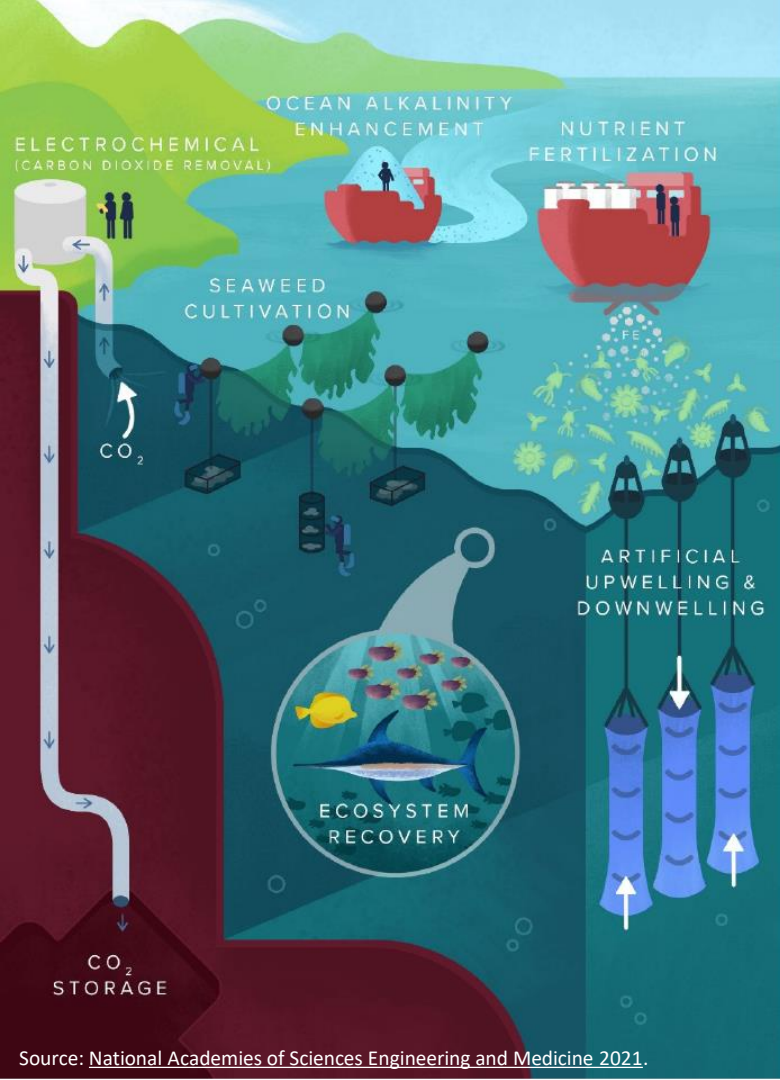
Carbon removal approaches in the ocean



WHY OCEAN CDR?

- Vast area, 70% of globe
- Significant demonstrated capacity to store carbon
- Can diversify portfolio of carbon removal approaches
- Reduces pressure on land-based resources





WHAT ARE OCEAN CDR APPROACHES?

- Biotic approaches:
 - Coastal wetland restoration
 - Seaweed cultivation
 - Ocean fertilization
 - Artificial upwelling
- Abiotic approaches:
 - Ocean alkalinity enhancement
 - Electrochemical techniques
 - Artificial downwelling

SEAWEED CULTIVATION



- **What:** Cultivation of seaweed then purposeful sinking to the deep ocean for sequestration
- **Uncertainties:** Optimal cultivation and harvesting methods, MRV, permanence
- **Development efforts:** Running Tide, Seafields, Seaweed Generation, ARPRA-E MARINER

OCEAN ALKALINITY ENHANCEMENT



- **What:** Addition of ground alkaline materials to surface waters that react with dissolved CO_2 lock it away
- **Uncertainties:** Environmental impacts in the ocean and from feedstock extraction; MRV
- **Development efforts:** Vesta, Carbon to Sea Initiative, PNNL, PMEL

COMPLEXITIES OF OCEAN CDR

- Small knowledge base
- Transboundary nature of the ocean
- Challenges with measurement, reporting, and verification (MRV)
- Lack of fit-for-purpose governance framework
- Importance of public perception and social license





POTENTIAL OF OCEAN CDR

With more attention and investment, ocean CDR could:

- Potentially provide multi-gigaton scale removal
- Help maintain the U.S. position as a leader in technology development and innovation
- For some approaches, provide other, non-carbon, benefits like reducing ocean acidification
- Provide jobs



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THANK YOU!
